ONTARIO HERITAGE TRUST

BRINGING OUR STORY TO LIFE

Heritage Matters

A publication of the Ontario Heritage Trust
Volume 14, Issue 1, February 2016

Ontario's medical legacy

Realizing the dream: The discovery of insulin

Vera Peters and the fight against breast cancer

Repairing hearts: Innovations in cardiac surgery

Medical science and innovation in Ontario

An enduring legacy

Ontario has contributed much to the world in the field of medical science. Advancements in cancer treatment, heart surgery and stem cell research are just three examples. These achievements – and the men and women who made them – are part of the very fabric of our society. This fascinating topic is closely connected to the history of compassion, education and community building.

For thousands of years, informed by traditional ways of knowing, First Nations peoples treated illness with natural remedies and physical procedures – like massage, sweat lodges and baths. Often linked to spiritual beliefs, these medical traditions were part of life and community, passed on verbally from one generation to the next. Much of this was, and continues to be, based on the medicine wheel that symbolizes the interconnection of all parts of life – spiritual, physical, mental and emotional – the cycles of nature and the circular journey of life.

With the arrival of the Europeans to Ontario came new contagious diseases and western medicine, with its contrasting linear world view and scientific approach. But medicine in the colonial era was nothing like what we know today. Pharmaceutical science was in its infancy: the existence of germs as agents of disease was unknown, and bloodletting to balance the humours was still a common treatment for illness.

In the late 18th and for much of the 19th centuries, medical professionals were educated abroad. This fact began to change with the establishment of medical schools, first in St. Thomas in 1824 and then in Toronto in 1843. Many of Ontario's hospitals and medical institutions have their roots in the 19th century, including the College of Physicians and Surgeons of Ontario (1869), the Ontario College of Pharmacists (1871), The Hospital for Sick Children (1875) and the Ontario Provincial Board of Health (1882).

Today, Ontario is home to many globally significant research institutions and hospital networks, six medical schools, a range of professional associations and advocacy groups that strive to continue to improve health care in Ontario and beyond. These institutions have had a lasting impact on community development, research and education, contributing to an enduring legacy.

I invite you to join us on this journey of discovery about medical science and innovation. You can learn more about our achievements in this field and the ingenious individuals involved by taking part in events, and by visiting museums and historical sites across the province. Doors Open Ontario 2016 will also showcase medical science and innovation. Many hospitals, doctor's homes/offices, university laboratories and other facilities will be included in Doors Open events as communities come to better understand the complex and ongoing history of health care and well-being.

Beth Hanna

Beth Hanna
CEO, Ontario Heritage Trust

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This issue of Heritage Matters, published in English and French, has a combined circulation of 9,200. Archived copies of Heritage Matters are available on our website at www.heritagetrust.on.ca/hm.

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Produced by the Ontario Heritage Trust
(an agency of the Ontario Ministry of Tourism, Culture and Sport).

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Publication Agreement Number 1738690
E&OE ISSN 1198-2454 (Print)
ISSN 1911-446X (PDF/Online)
02/16
Aussi disponible en français.

Ontario

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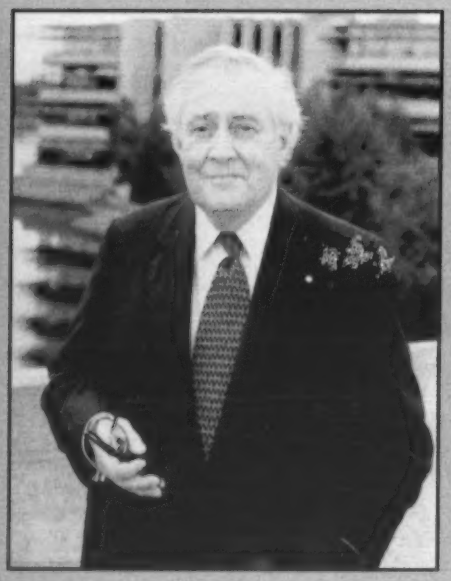
Cover: Interior of the Niagara Apothecary, a Trust-owned property in Niagara-on-the-Lake. Photo: Roser Martinez



Ontario's medical heritage

Many people have heard of Banting and Best and their discovery of insulin, but fewer know about the larger team of Ontarians, including Drs. Collip and MacLeod who, in 1922, helped develop this life-saving treatment for diabetes. In fact, a good number of Ontario's medical innovators remain little known outside their medical professions and the scientific community. Working with our partners, the Trust plans to shed light on their contributions as we celebrate Ontario's history of medical science and innovation this year.

The number of innovations in medical science and technology conceived in Ontario is extensive, and the stories fascinating – including discoveries and inventions related to pharmaceuticals, medical procedures and devices. For instance, plastic surgeon Dr. Ross Tilley used an innovative and highly successful approach to burn management while working with wounded soldiers and airmen during the Second World War. In the 1950s, Dr. Vera Peters proved that Hodgkin's disease – and, later, breast cancer – could be effectively treated with radiation. Innovations in cardiac surgery, combined with the invention of the pacemaker by Drs. Wilfred Bigelow and John Callaghan and engineer John Hopps continue to save and improve countless lives throughout the world.

The provision of universal health care represents another significant aspect of our province's medical legacy. Indeed, the public health insurance program is an integral part of our identity as Canadians and Ontarians. This year marks the 50th anniversary of publicly funded health care in Ontario, and the introduction of the national Medical Care Act in Ottawa. In 1966, the Ontario government introduced the Ontario Medical Services Insurance Plan, which created the province's first universal health care system. As a result, every resident of the province is entitled to emergency and preventive care, known as OHIP since 1972. In education as in public policy, there have been significant and often pioneering developments in Ontario.

Message from our Chairman

I trust that you will find the stories in this issue engaging, illuminating and meaningful, and that they will engender a growing curiosity about Ontario's great innovations in medical science. May I invite you to examine the subject in more detail at the Museum of Health Care at Kingston or the Canadian Medical Hall of Fame in London. While in London, you may wish to visit the home of Sir Frederick Banting – a co-discoverer of insulin – or see his desk at the Ontario Science Centre in Toronto. At the Trust's Niagara Apothecary and at Fulford Place in Brockville, you can also see special exhibits on medical heritage.

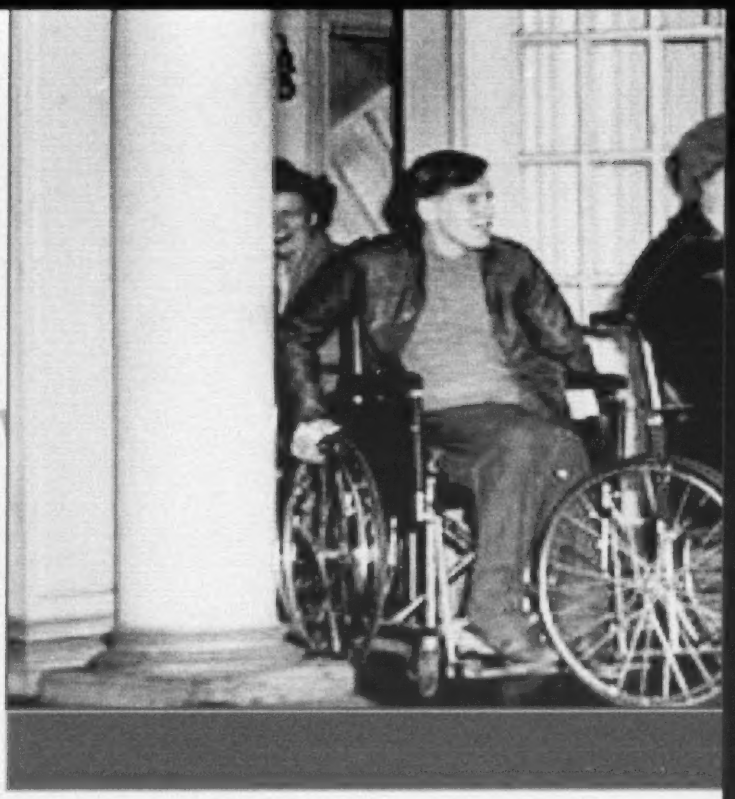
There is much to see and learn about the legacy of medical science and innovation in Ontario – a rich and varied part of our province's heritage.

Tom Symons

Thomas H.B. Symons
C.C., O.Ont, FRSC, LLD, D.Litt., D.U., D.Cn.L., FRGS, KSS
Chairman

Ontario's medical legacy

By Dr. Jacalyn Duffin



In the mid-19th century, a typical doctor ran a solo practice, often making house calls on horseback or by sleigh. Many treatments offered relief for symptoms, but cures belonged to nature. The spectre of infections – diphtheria, whooping cough, measles, scarlet fever and smallpox – was ever present. Few specialists were available; a doctor delivered babies, set fractures, pulled teeth, mixed medicines and comforted those in need. Many patients could not pay medical bills and the concept of vacations had yet to be invented. Much has changed in the last 150 years.

Until the later 19th century, most Ontario practitioners studied in Britain or the United States. At least three medical schools in Ontario, however, supplied skilled practitioners to local communities: Duncombe's in St. Thomas (1824), Rolph's School (1843) and King's College (1843), both in Toronto. Physicians communicated with each other around the world through journals that featured original research and reports of innovations. Through these journals, Ontario doctors were able to apply the great 19th-century discoveries – anesthesia by 1847, antisepsis by 1867 and germ theory by 1882. The latter prompted the creation of a formal department of public health and the rapid incorporation of microscopy and bacteriology into clinical practice and education.

But some innovations are wholly Canadian, and many were from Ontario. Arguably, the most famous was the discovery of insulin by Drs. Frederick Banting, Charles Best, J. Bertram Collip and J.J.R. Macleod. Their achievement provided an effective treatment (not cure) for a deadly disease that was, and still is, all too common. For their efforts, they won the 1923 Nobel Prize.

By 1929, and for the next two decades, Best and his colleagues worked on finding safe uses for the blood thinner heparin. Although it had not originally been a Canadian discovery, they championed its applications in treating phlebitis, gangrene and pulmonary embolus. Heparin also meant that blood could be kept from clotting on contact with instruments, making it an essential step in advancing the possibilities of cardiac surgery.

In Toronto, a surgical team led by Wilfred G. Bigelow worked to repair heart defects. They had to find a way to decrease the body's need for oxygen in order to stop the heartbeat for short periods without damaging tissues. Inspired by the slowed metabolism of hibernating animals, they induced hypothermia to lower body temperature, allowing extra time for operating. This creative 1950s technique was eventually superseded by the advent of the heart-lung bypass machine, which took over the job of pumping blood while the heart was stopped.

Lyndhurst Lodge, a community-based rehabilitation centre, was established to assist Canadian veterans who had suffered spinal cord injuries in the Second World War. Photo Courtesy of Spinal Cord Injury Ontario.

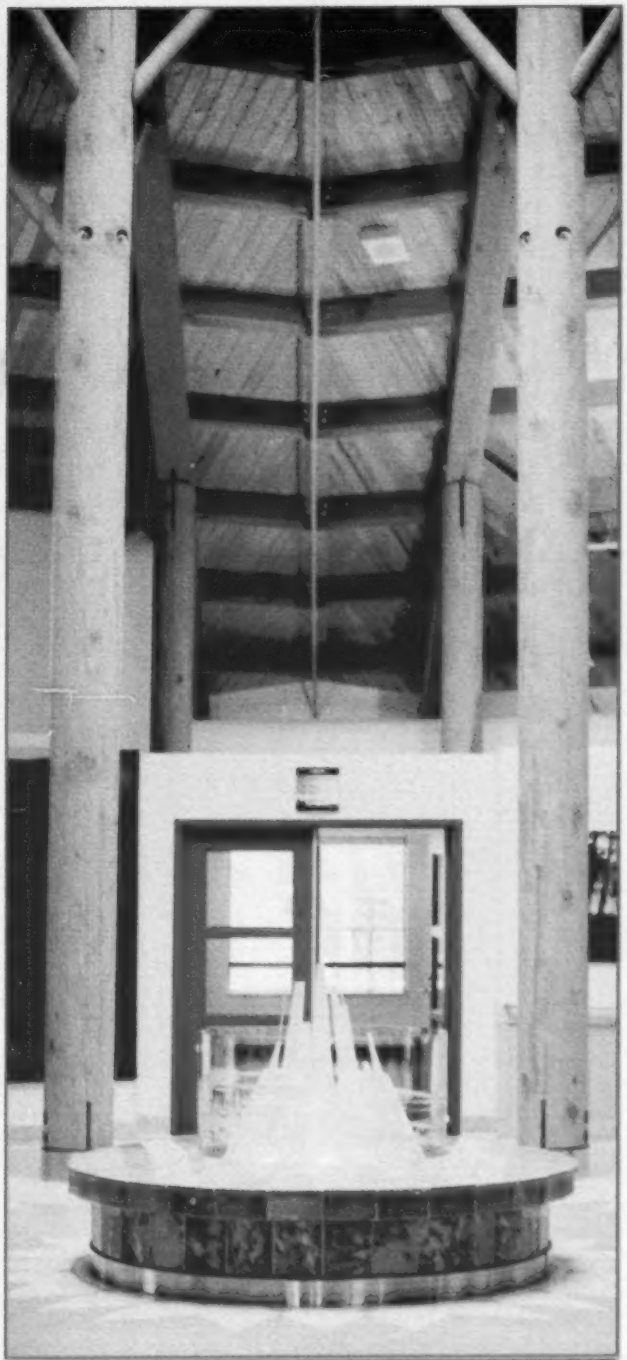
The Second World War ravaged hundreds of young adults. Hoping to rehabilitate spinal-cord-injured soldiers, neurosurgeon Edmund H. Botterell and physiatrist Albin Jousse created a special program at Toronto's Lyndhurst Lodge in 1945. Their mission was to restore the disabled soldiers to active life through physical and mental therapy. The focus expanded to include civilian patients with other disabilities, and Lyndhurst eventually evolved into a major research institute for rehabilitation.

In the care of mothers and children, several Ontario initiatives were firsts for Canada, if not the world. Elizabeth Bagshaw established a birth control clinic in Hamilton in 1932. Vaccination of infants against the infectious scourges of the previous century became a requirement for admission to public school. Additionally, Toronto's Hospital for Sick Children witnessed the advent of brilliant surgical procedures for congenital heart disease and dislocated hips.

Following the observations of Pierre and Marie Curie, radioactive substances were soon applied to the treatment of cancer. From the 1930s, the town of Port Hope hosted the Eldorado Company for refining radium. Inserted into needles and other devices, radium treated malignant tumours in all parts of the body. The results were impressive. Its byproducts include uranium, which led to Port Hope's involvement in the Manhattan project to produce the atomic bomb. Eldorado brought jobs and prosperity to Port Hope. Later, citizens learned of the dangers of radiation, and following 20 years of controversy, radium production ceased. Uranium production continues but the safe disposal of nuclear waste remains a significant challenge.

The province created the Ontario Cancer Treatment and Research Foundation in 1943 (OCTRF, now Cancer Care Ontario) to coordinate access to the new treatments of radiation and chemotherapy, and to promote research. In 1951, under the auspices of the clinic in London, the province competed with Saskatchewan for the first installation and use of a cobalt-60 unit. Whichever province deserves that honour, Ontario succeeded in luring the brilliant teacher-scientist Harold E. Johns from Saskatoon to Toronto, where he authored the definitive book on radiation physics and inspired generations of young physicists and doctors.

A little-known Ontario achievement in cancer treatment was the 1958 isolation of vinca alkaloids from the periwinkle plant in the London laboratory of Robert Noble, by his chemist, Charles Beer, and their assistant, Halina Robinson. Jamaicans had sent dried leaves of the vinca plant to Canada, hoping it would prove to be a source of oral insulin. Instead, its purified extracts – vinblastine and vincristine – became drugs that are still widely used and have long been recognized as a cure for childhood leukemia.



The Gathering Area in the Sioux Lookout Meno Ya Win Health Centre (SLMHC) is designed to suggest a clearing in a forest, a lodge or longhouse, with a fireplace that symbolizes unity with the community. Photo used with permission of the SLMHC.

Another research achievement came in 1963 from Ontario Cancer Institute (OCI) scientists James Till and Ernest McCullough, who identified stem cells. Among the multiple applications of their work are the scientific foundations of the bone marrow transplantation developed by American Nobel laureate, E. Donnell Thomas. Decades later, OCI scientist Tak Mak cloned the T-cell receptor and pioneered research in genetically altered mice. His achievements have garnered multiple awards and inspired thousands of scientists around the globe.

The array of treatments and claims of manufacturers led McMaster's David L. Sackett and Gordon H. Guyatt to argue for a more judicious use of scientific information. They recommended careful use of randomized, controlled trials – preferably double-blind – to evaluate changes in medical practice and construction of guidelines. This movement came to be called evidence-based medicine, a term coined by Guyatt in 1992. It now pervades all aspects of clinical science on an international scale.

Canada's first training school for nurses, c. 1875 (St. Catharines). Canadian Museum of History, 2001-H0006.4, IMG2008-0633-0021.

Photo courtesy of the London Health Sciences Centre

Ontario also pioneered innovations in health-care delivery. For example, psychiatric hospital beds were reduced by 80 per cent from 1960s levels; what had once been 16 residential homes for the mentally disabled were closed by 2009. Slow to conform to the Canada Health Act (1984) and following the 1986 doctors' strike, the province made strides in developing policies around hospital and home care that reflect local needs and wise use of resources. For example, between 1996 and 2000, the Health Services Restructuring Commission mandated the elimination of more than 40 hospitals by closure or merger, and an increase in home care services. Similarly, primary care reform saw numbers of family physicians paid by traditional fee-for-service plunge from 95 per cent in 2000 to 28 per cent in 2013. Along similar lines, the Local Health Integration Network (LHIN) was created in 2007 to enhance community involvement in planning.

In terms of education, Canada's first school for the training of lay nurses opened in St. Catharines in 1874 and continued for a century. In 1897, Lady Aberdeen, wife of the then-Governor General, launched the Victorian Order of Nurses. Although the program stretched from coast to coast, sites quickly appeared in Ottawa, Toronto and Kingston, and cottage hospitals were built in isolated areas. Nurses who took on remote jobs launched the nurse-practitioner and midwifery programs that came to Ontario in 1972 and 1993 respectively.

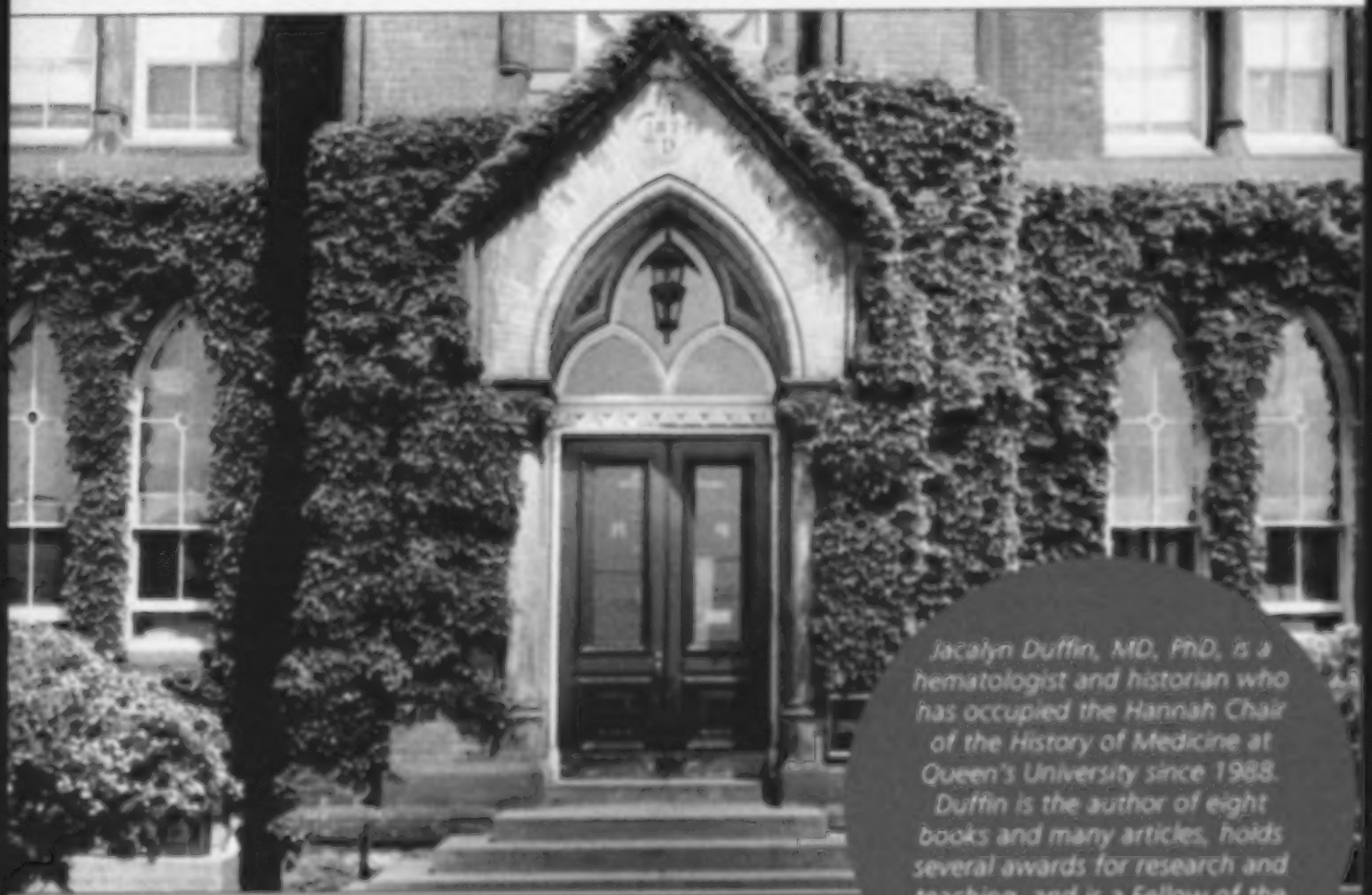
Over time, six medical schools became affiliated with Ontario universities. The problem-based-learning format of education used at McMaster medical school from its 1965 inception is now widely copied across the developed world, and is often wrongly attributed to Harvard Medical School. The newest, the Northern Ontario School of Medicine, opened in 2005 in both Sudbury and Thunder Bay.

The first successful hand transplant in Canada took place at Toronto Western Hospital on January 12, 2016. Dr. Christian Veillette (right), orthopedic surgeon, looks at an X-ray to ensure proper alignment of the patient arm and donor arm as they are fused together. Photo courtesy of the University Health Network.

It emphasizes partnering with First Nations populations and mandates month-long experiences for its students in indigenous communities.

Since the 1986 doctors' strike, a collaborative effort between Ontario medical schools developed a set of criteria to address what citizens expect from their doctors. Roles went beyond the predictable goals of scientific knowledge and technical skill. Funded by the philanthropic Associated Medical Services (AMS), this program was adopted by the Royal College of Physicians and Surgeons of Canada to become the basis of the CanMEDS competencies, a program that influences undergraduate and postgraduate medical education internationally. AMS also created the Jason A. Hannah Chairs for the History of Medicine in Ontario medical schools, more recently extended to other provinces. This gift emphasizes the role of history and humanities in clinical education, and makes us the envy of the medical history community.

In comparison to her colleague of 150 years ago, an Ontario practitioner now leads a busy life, but she often shares the load with a team. She can rely on many effective treatments and specialists. Her patients are immunized against infection and can expect cures and comfort for ailments, and they do not face unaffordable bills. She looks forward to continuing to learn about innovations that have been evaluated through robust clinical trials. But their stories fascinate and remind us of how they have improved quality of care and life for us all.



The former Connaught Laboratories at the University of Toronto (1958). The Spadina Building became a part Connaught Laboratories in 1943 and served as the headquarters for the Laboratories from 1956 to 1966. Photo courtesy of Sanofi Pasteur Canada (Connaught Campus) Archives.

Jacalyn Duffin, MD, PhD, is a hematologist and historian who has occupied the Hannah Chair of the History of Medicine at Queen's University since 1988. Duffin is the author of eight books and many articles, holds several awards for research and teaching, and is a Fellow of the Royal Society of Canada and the Canadian Academy of Health Sciences.

Doctors, discoveries and developments:
Medical achievements and health care in Ontario

Left: Dr. Leone Farrell. Photo: Sanofi Pasteur Canada (Connaught Campus) Archives. Right: George Klein. Photo: National Research Council.

1824 Dr. Charles Duncombe opens the first medical school in Ontario, in St Thomas.

1839 College of Physicians and Surgeons of Upper Canada is formed.

1843 Christopher Widmer and John Rolph establish the Toronto School of Medicine (now the University of Toronto Medical School).

1861 Dr. Anderson Ruffin Abbott is the first Canadian-born doctor of African descent.

1867 The Canadian Medical Association is formed.

1869 A new College of Physicians and Surgeons of Ontario is incorporated by the Ontario Medical Act.

1871 Ontario College of Pharmacists is incorporated.

1875 Nurse Elizabeth McMaster opens a children's hospital in an 11-room house in Toronto, which eventually becomes the Hospital for Sick Children.

1880 The College of Physicians and Surgeons of Ontario grants Emily Stowe a license to practise medicine.

1882 Ontario Provincial Board of Health is created.

1883 Women's Medical College is opened (later Women's College Hospital).

1897 Daniel David Palmer of Port Perry, Ontario founds the field of chiropractic in Davenport, Iowa.

1911-12 Dr. Herbert Bruce opens Toronto's Wellesley Hospital and its affiliated nursing school.

1918-20 Spanish influenza (Spanish flu) arrives in Ontario.

1919 Canada establishes the Department of Health as a response to the Spanish flu crisis.

1920-29 University of Toronto researchers discover heparin as a way to control blood clotting.

1921 Drs. Banting, Best, Collip and Macleod at the University of Toronto discover insulin as an effective treatment for diabetes.

1940 The anti-gravity suit is developed by Wilbur R. Franks; the suits were used during the Second World War, and all G-Suits now worn by air force pilots, astronauts and cosmonauts are based on his design.

1927 Dr. Gordon Richards founds the Canadian Association of Radiologists and establishes radiotherapy as a medical discipline.

1930 The baby food Pablum is developed by Drs. Tisdall, Drake and Brown at Toronto's Hospital for Sick Children.

1938 Ontario is the world's first large jurisdiction to mandate the pasteurization of milk.

1943 Dr. Gordon Murray inserts cardiac valve surgery.

1945 Dr. Edmund W. Botterell opens the Lyndhurst Lodge in Toronto – the first rehabilitation centre dedicated to spinal-cord-injured patients in North America.

1941 Dr. Jessie Gray becomes the first woman to become a fellow of the Royal College of Surgeons of Canada.

1946 Veterans Centre at Toronto's Sunnybrook Hospital opens.

1945 Dr. Gordon Murray invents an early dialysis machine for treatment of kidney disease.

1944 Ontario-born and trained Dr. Albert Ross Tilley is made an Officer of the Order of the British Empire for his work and leadership in pioneering new techniques for treating British burn victims, soldiers and airmen.

1954 Colin McLaurin creates the McLaurin Hip Disarticulation Prosthesis at Sunnybrook Hospital in Toronto. This unique prosthesis relied on biomechanics to achieve stability and improve gait.

1953 Mechanical engineer, George Johann Klein from the National Research Council of Canada laboratories in Ottawa, invents the first electric wheelchair for quadriplegics.

1956 Connaught Medical Research Laboratories produces some 3,000 litres (670 gallons) of poliovirus fluids for a massive field trial of the Salk inactivated polio vaccine.

1952 The drug antiblastine is discovered at the University of Western Ontario by Drs. Robert Noble and Charles Beer; used with other drugs, it has a major impact on controlling the growth of some types of cancer.

1950–75 Dr. Vera Peters proves that a lumpectomy, followed by radiation, is as effective a treatment as radical mastectomy.

1966 The Ontario Government introduces the Ontario Medical Services Insurance Plan – the province's first universal health-care system that insures physicians' service. By 1972, the plan is known as OHIP. Every resident of Ontario is entitled to access free emergency and preventive care.

1980 Dr. Wilbert Keon is the first Canadian doctor to implant an artificial heart.

1984 The Ross Tilley Burn Centre opens at Toronto's Bladderay Hospital.

Early 1960s Drs. Ernest McCulloch and James Till identify and isolate transplantable stem cells in mice; this discovery allows for the study of individual stem cells in human adult bone marrow.

1947 Dr. William T. Mustard develops the first successful cardiovascular surgery to correct a congenital heart defect in newborns.

1950 Dr. Vera Peters discovers that a significant proportion of people suffering with Hodgkin's disease can be cured with high doses of radiation.

1952 Dr. John Callaghan discovers that hypothermia slows the human circulation system sufficiently to permit open-heart surgery.

1952 The Princess Margaret Hospital in Toronto is founded as the Ontario Cancer Institute.

1958 Engineer John Hopps, from Ottawa's National Research Council, develops the first artificial pacemaker.

1959 Dr. Gordon Murray develops interventricular septal defect repair for children born with holes in their hearts.

1967 The discovery of the cobalt bomb leads to the production of radioactive cobalt-60. Surgeon at Chalk River, Ontario, Harold E. Johns pioneers the use of cobalt-60 as a gamma ray source for radiation therapy in cancer cases.

1989 Canadian volunteers first come together to create a Médecins Sans Frontières/Doctors Without Borders (MSF) association. MSF in Canada formally joins the international movement in 1991.

1989 Dr. Lap-Chee Tsui discovers the gene responsible for cystic fibrosis. This is considered the most significant breakthrough in human genetics in half a century.

1963 Ontario is the first province to regulate midwifery as part of the Registered Health Professions Act. Ellie Cressman, native of New Hamburg, Ontario, is awarded the Order of Ontario for her role in the efficacy of midwifery.

1965 The longest physicians' strike in Canada occurs in Ontario in 1965, when the Ontario Medical Association called a work stoppage to protest the government's ban on extra billing.

1980s Dr. John Dick, from the Ontario Cancer Institute, grows the existence of cancer stem cells – a type of cancer cell responsible for the growth and spread of the disease.

1959 Dr. W. Douglas Boyd, a cardiothoracic surgeon in London, Ontario, performs the world's first totally closed-field, computer-enhanced, robotics-assisted coronary bypass operation on a beating heart.

2004 The Traditional Chinese Medicine Act establishes the College of Traditional Chinese Medicine Practitioners and Acupuncturists of Ontario.

2005 The SARS epidemic hits Canada, approximately 60 per cent of all known SARS cases occurred in Ontario. In total, 44 people in Canada died from SARS, approximately 800 became ill and 25,000 Toronto residents were placed under quarantine.

2006 The role of nurse practitioner is regulated in Ontario.

Late 1990s Dr. Anthony Lang and Andres Lozano develop deep brain stimulator (DBS) at Toronto Western Hospital. DBS has improved the lives of hundreds of people suffering from Parkinson's disease.

2020 Dr. Dolph Tulving from Toronto Baycrest Centre is awarded the Canada Gairdner International Award for pioneering research in the understanding of human memory and for providing the necessary framework within which science in neuroimaging, neurophysiology, and neuropharmacology can be integrated.

2009 Ontario Stem Cell Initiative is launched at the University of Toronto, bringing together 60 scientists for a province-wide partnership to make Canada an international leader in this technology.

2010 50th anniversary of the province's first universal health care system.

2007 The title of Nurse Practitioner (Primary Care) is protected title in Ontario. Nurses in four specialty areas of medicine can use this title: primary health care, pediatrics, adult and geriatrics.

2010 Canadian researchers launch the world's first clinical trial of a novel investigational therapy that uses a combination of two viruses to attack and kill cancer cells and stimulate an anti-cancer immune response.

2010 The successful hand transplant is jointly performed at Toronto Western Hospital, a part of the University Health Network.

By 2015 Canadian life expectancy at birth has grown from 77.1 in 1921 to 80.7.

2010 Sioux Lookout Meno Ya Win Health Centre is established – an extended-care facility that merges traditional First Nations and modern healing practices.

Vera Peters and the fight against breast cancer

By Dr. Charles Hayter

Dr. Peters preparing a patient for radiotherapy. Collection of Dr. Charles Hayter

Today, women with early breast cancer are usually treated with breast-conserving therapy (removal of the cancerous lump followed by radiation). This approach is a relatively recent innovation that only became commonplace in the 1990s. Before then, women were subjected to radical mastectomies, an operation that cured cancer but left women disfigured and in pain. Toronto's Dr. W. Vera Peters played a pivotal role in this transition.

Vera Peters was born in 1911 on a farm in Thistletown, outside Toronto. She entered the University of Toronto at age 17 and, after a brief period studying math and physics, switched to medicine – one of only 10 women in a class of over 100. She supported her studies by waitressing on a cruise ship, where she met her future husband, Don Lobb, a high school physical education teacher.

While she was a medical student, Peters' mother died of breast cancer. This event was a turning point in her life. Through her mother's illness, she met her future mentor, Dr. Gordon Richards, the head of radiotherapy at Toronto General Hospital. Peters had been fascinated by Richards' lectures, and her personal connection through her mother's illness crystallized her desire to enter the new field of radiation oncology.

After graduating from medical school in 1936, Peters joined Richards first as his apprentice and later as his assistant. She was to spend the remainder of her career in Toronto – first at Toronto General, later at Princess Margaret Hospital.

Her first major scientific contribution occurred in 1947. Richards asked her to review the hospital's experience with Hodgkin's disease. Peters embarked on a review of the associated cases treated at Toronto General and, in 1950, published a landmark paper that demonstrated that Hodgkin's disease could be cured with radiotherapy. She also found that the extent of the disease at the time of diagnosis was the most important factor influencing survival. Her staging classification was the foundation for the staging system still used today. While her results were met with scepticism, most physicians eventually became convinced that Hodgkin's disease was curable.

Peters' second major contribution was in breast cancer treatment. When she began her career, the standard treatment for breast cancer was the radical mastectomy – the removal of the breast, skin, nipple, tissues in the armpit and chest muscles. As a woman, she was sensitive not only to the physical ravages of mastectomy, but also to what she called the "associated emotional trauma." She witnessed the devastating effects on body image, sexuality and femininity.

Peters became determined to find a gentler approach. She was aware that, over the years, a number of Toronto women had been treated with lumpectomy (removal of the tumour) followed by radiation, but it was unknown whether this procedure cured as many women as mastectomy. With quiet resolve, she embarked single-handedly on a review of 8,000 cases of breast cancer

Peters in her office at Princess Margaret Hospital. Photo: Dr. Jenny Ingram.

Dr. Charles Hayter is a staff radiation oncologist at Mississauga's Peel Regional Cancer Centre and Associate Professor of Radiation Oncology at the University of Toronto. He is the author of Radical, a play about Vera Peters.

Acknowledgements: Dr. Jenny Ingram, Mrs. Sandy Clark, Dr. Don Cowan and Jin interviews with Dr. Peters from the Ontario Medical Association Archives.

treated in Toronto since 1939 and found that women treated with lumpectomy and radiation had the same cure rate as women who had undergone mastectomy. Her findings – first presented in 1975 – were met with hostility by the surgical establishment. It was only when a large American study confirming her results was published in 1985 that surgical practice slowly started to change.

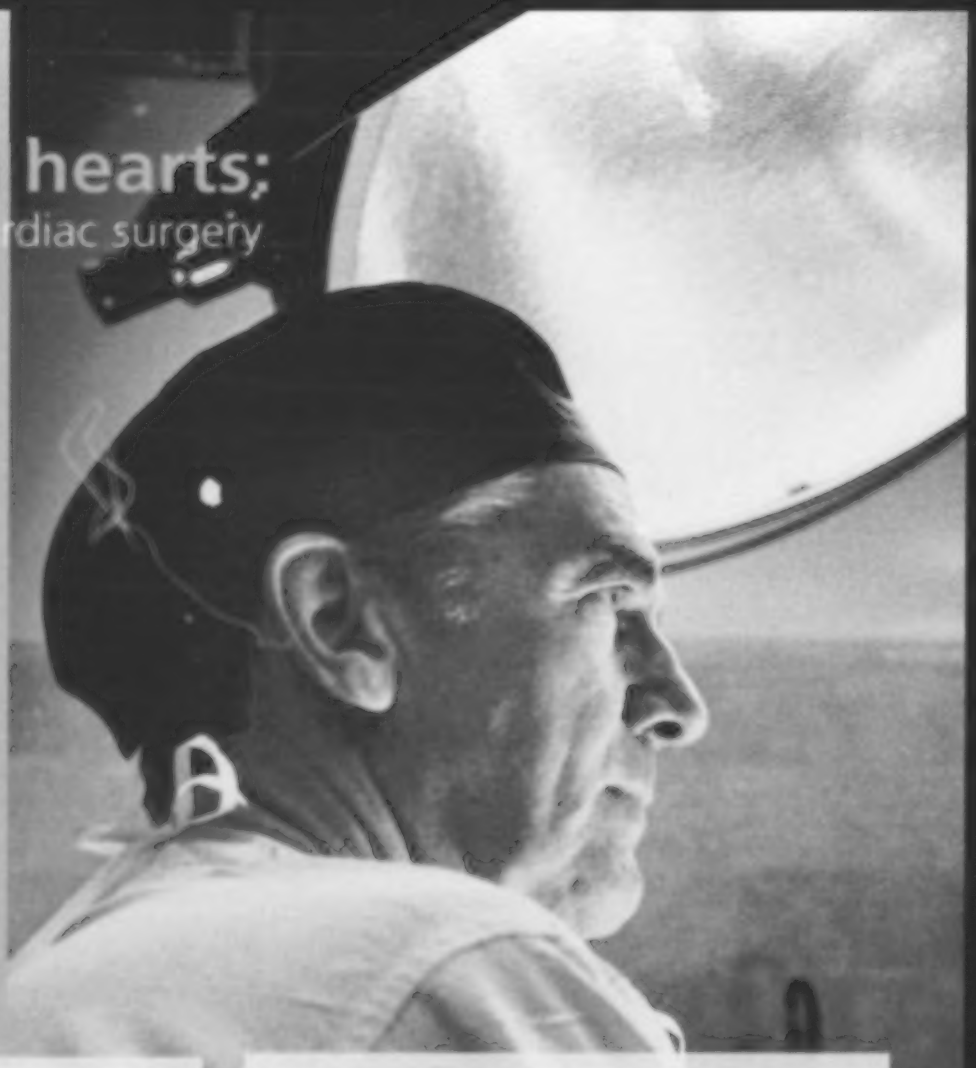
Peters retired from Princess Margaret in 1976 and started a consulting practice in Oakville. In 1984, she was herself diagnosed with breast cancer and, true to her convictions, was treated with lumpectomy. Nine years later, at the age of 82, she was diagnosed with lung cancer. She received palliative radiotherapy and died on October 1, 1993 at the hospital where she had spent most of her career – Princess Margaret.

During her lifetime and after, Peters was widely recognized for her achievements. In 1975, she was appointed a Member of the Order of Canada. In 2010, she was inducted posthumously into the Canadian Medical Hall of Fame. The Peters-Boyd Academy at the University of Toronto's Faculty of Medicine is named in her honour.

Peters is remembered by her former students not only as a compassionate physician who always put patients first, but also as a pioneering role model at a time when there were few women in the top ranks of medicine.

Repairing hearts:
Innovations in cardiac surgery

By Dr. Shelley McKellar

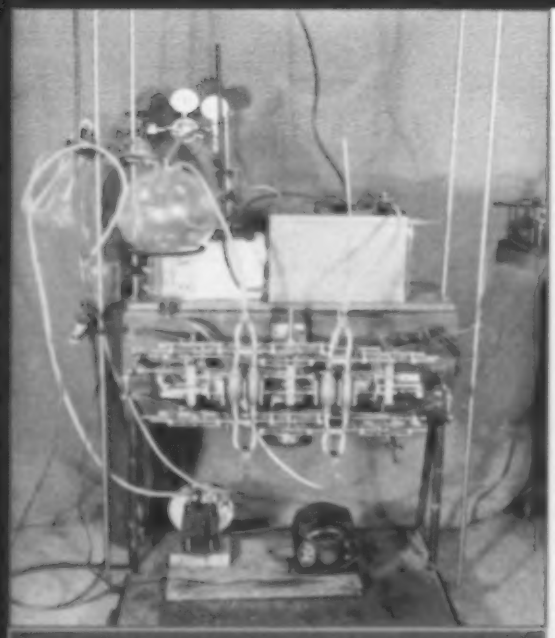


Once considered off-limits to the surgeon's scalpel, a diseased heart is no longer an immediate death sentence.

In 1900, the medical community could treat only the symptoms of heart disease. Doctors offered digitalis to treat heart failure, oral diuretics to fight fluid retention brought on by heart failure and, from the 1930s, drugs to lower blood pressure. Various drugs were prescribed to improve heart contraction, reduce heart work and protect against blood clots, but rarely did this reverse cardiac damage. By mid-century, new surgical procedures were introduced to repair congenital and acquired heart disease conditions to which the innovative work of several Ontario surgeons – Drs. Wilfred Bigelow (1913-2005) and William Mustard (1914-87) in Toronto as well as Dr. Wilbert Keon (b. 1935) in Ottawa – contributed significantly. Their work ushered in the much-heralded era of open-heart surgery and corrective cardiac procedures for Canadians.

Until 1950, a handful of surgeons, including Dr. Gordon Murray (1894-1976) of the Toronto General Hospital, performed closed-heart surgery, operating on beating, blood-filled hearts to shut the holes in the heart walls of children or to split open the hardened heart valves of adults. But these procedures resulted in only limited success. Drs. Wilfred Bigelow and William Mustard led the next generation of surgeons who performed open-heart surgery by pioneering new techniques to tackle more complex, corrective cardiac operations with better results.

Wilfred G. Bigelow, A2012-0009/002 (69), University of Toronto Archives (UTA), Robert Lansdale Photography Ltd.



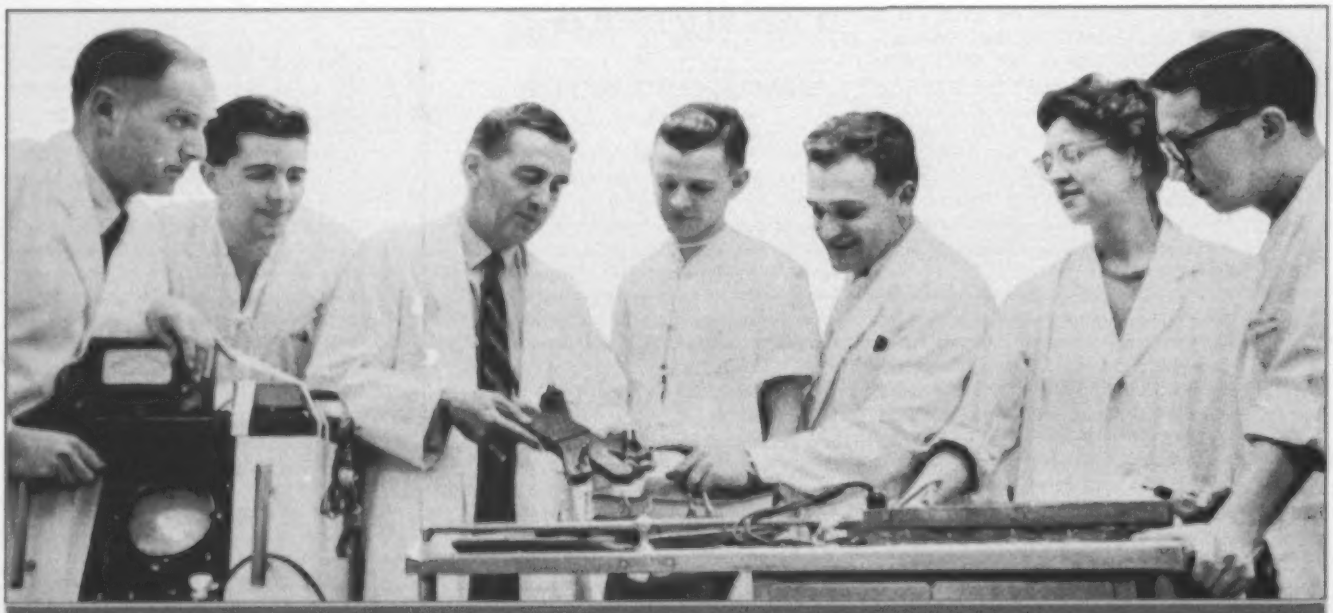
Dr. William Mustard's bypass machine, in which monkey lungs were suspended in the glass flask and used as the oxygenator. Photo courtesy of Hospital Archives, The Hospital for Sick Children, Toronto.

Dr. William Mustard. Photo courtesy of Hospital Archives, The Hospital for Sick Children, Toronto.

In 1947, Bigelow began studying the effects of general hypothermia on the metabolism of the body, specifically examining how low body temperatures affect heart function. His idea was to cool the whole body, reduce the oxygen requirements, interrupt the circulation and then open the heart to repair the problem. He successfully introduced a hypothermia technique that cut blood circulation to the heart for eight minutes, thus providing a near bloodless heart for the surgeon and no brain damage for the patient. Bigelow remembers his colleagues' initial skepticism, writing that, "It was a blasphemy. This concept completely contradicted currently accepted teaching, which was to avoid any fall in body temperature." By the early 1950s, the medical community praised hypothermia as a simple and safe method to permit the surgical correction of uncomplicated heart malformations. Also during this period, as a spinoff of the hypothermia research, Bigelow and National Research Council engineer Jack Hopps developed an external pacemaker to resuscitate arrested hearts with electric stimulation.

At Toronto's Hospital for Sick Children, Mustard needed more than eight minutes to repair the damaged hearts of blue babies, who suffered from recirculating deoxygenated blood that turned their skin, lips and fingernails blue. Few blue babies lived to adulthood with this congenital condition. So, a method was devised to circulate and oxygenate the blood outside of the body while surgeons repaired a patient's heart defects. Mustard experimented using monkey lungs as a biologic oxygenator that connected to a blood pump. During the 1950s, he operated on 28 children using a monkey-lung oxygenator, but only three lived. He abandoned monkey lungs in favour of mechanical oxygenators and he reported greater patient success. In 1963, Mustard introduced a new blue baby operation for transposition of the great vessels, which became known as the Mustard procedure.

Founded by Dr. Wilbert Keon, the University of Ottawa Heart Institute opened in 1976 and soon became a leading research and treatment centre for cardiovascular disease. In 1981, Ontario's first angioplasty – a surgical unblocking of a blood vessel – was performed here. In 1986, Keon replaced Noella Leclair's failing heart with a mechanical one in order to keep her alive. She became the first patient in Canada to receive a Jarvik artificial heart. A week later, Keon replaced the device with a donor heart and Leclair lived another 20 years.



Dr. W.G. Bigelow and colleagues in hibernation research are grouped around an electro-cardiograph machine and cooling bath. UTA Varsity Graduate (Spring 1961), pp. 56-57. Photo: University of Toronto Archives (UTA), Robert Lansdale Photography Ltd.

During the 20th century, surgery as a therapy expanded from simply cutting out disease to repairing damaged structures to later replacing body parts entirely. It was surgical researchers from Ontario with a vision of surgical possibilities – like Bigelow, Mustard and Keon – who expanded the boundaries in heart surgery by introducing bold, new techniques. As a result, thousands of Canadians benefit today from life-saving procedures made possible by innovations in open-heart surgery.

Shelley McKellar is the Hannah Chair in the History of Medicine at Western University. She is the author of Surgical Limits: The Life of Gordon Murray as well as a forthcoming book on the history of artificial hearts.

Indigenous traditional medicine

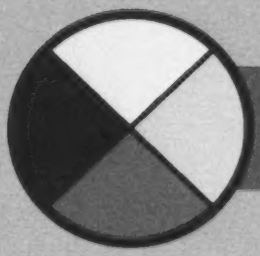
"Traditional medicine" refers to knowledge and practices of Indigenous peoples that promote health and well-being, and that have been passed down from generation to generation over hundreds and even thousands of years.

For many Aboriginal people (First Nations, Inuit and Metis), traditional medicine is part of a holistic philosophy of health and healing that is underpinned by a belief in the connectivity between emotional, spiritual, physical and mental well-being. The knowledge that informs traditional medicine derives from multiple sources, including traditional teaching, empirical observation and revelation. This knowledge is often imparted by elders or healers through a plurality of forms and practices, including herbal medicines, dances, ceremonies and counselling. Traditional medicine is closely tied to language, culture and the natural environment and is, therefore, specific to each community and connected to local knowledge and world view. The Anishinaabe term for medicine – *Mshki ki*, for example – derives from the words *Mshki*, meaning strength, and *ki*, which comes from the word *Aki*, meaning earth. It translates, therefore, as "strength from the earth," and demonstrates the fundamental relationship in traditional medicine between the individual and the natural environment.

The World Health Organization identifies "traditional medicine" as "the sum total of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement of treatment of physical and mental illness."

The medicine wheel is used by many First Nations in healing and teaching practices, and is an expression of the holistic nature of traditional medicine. Sometimes called "hoops," medicine wheels also vary from nation to nation in terms of their use and significance. Fundamental similarities, however, include their circular shape and division into four parts – representing physical, emotional, mental and spiritual factors. The medicine wheel is a symbol of harmony, balance, continuity and interconnectivity as they relate to the individual, the community and the universe.

The use of medicine wheels and other forms of traditional healing was harshly repressed in many places during the 19th and 20th centuries. Today, however, Indigenous communities are again recognizing the importance of traditional medicine as a means of improving the health and quality of life.



In addition to representing mental, physical, spiritual and emotional health, the quadrants of the medicine wheel are often used to represent the four seasons, stages of life, directions and elements of nature. The colours and colour placement in medicine wheels vary from nation to nation.

For more information about traditional medicine, visit:

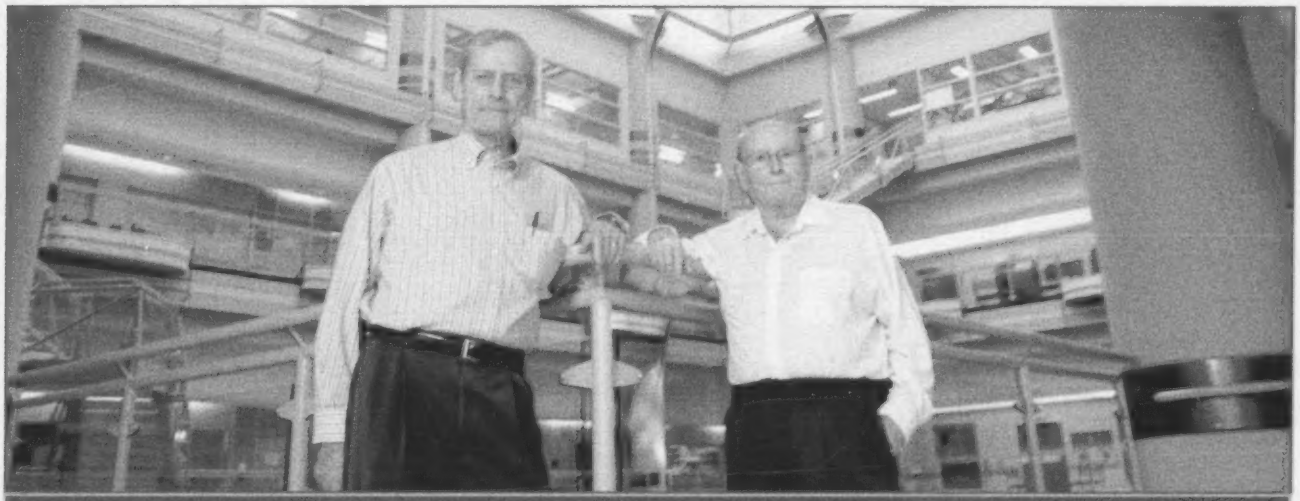
The National Aboriginal Health Organization website: www.naho.ca

The Native Women's Centre's Aboriginal Healing & Outreach Program: www.nativewomenscentre.com/files/AHOP_Brochure.pdf

The University of Ottawa Aboriginal Health webpage: www.med.uottawa.ca/sim/aboriginal_health_e.html

Blood-forming stem cells: An Ontario story

By Dr. Hans A. Messner



Drs. Jim Till and Ernest McCulloch. Photo: University of Toronto.

Blood . . . it circulates through our bodies, supplies energy, defends against internal and external danger, and heals injuries.

It comprises a miraculous network of highly specialized cells and substances that perform these tasks with precision in a highly regulated environment. Great strides were made in the 19th century to describe the multitude of blood cell types and to discover their functions. Their origin, however, remained shrouded and a matter of speculation. As early as 1868, an intriguing hypothesis was voiced by one of the early pioneers suggesting that blood cells may originate from a single cell destined to produce the myriad of blood cells – and, for the first time, the name stem cell was coined.

In the fall of 1960, the key was found to unlock the secrets of blood-forming stem cells. By then, it was known in the wake of the nuclear holocaust of 1945 that the effects of lethal irradiation on the blood system could be restored by injecting normal bone marrow cells. Two young scientists, Drs. Jim Till and Earnest McCulloch, recently hired to the newly founded Ontario Cancer Institute at Toronto's Princess Margaret Hospital, were determined to learn more about these intriguing repair mechanisms. Till (a physicist) and McCulloch (a physician), both different in background and personality, formed a unique research team that dominated stem cell research for decades.

One of their first questions was to investigate whether or not the observed rescue effect would be influenced by the dose of radiation: the higher the dose, the less likely the benefit. Then, in 1960, McCulloch evaluated one of their experiments designed to test whether the rescue effect of marrow could be enhanced by injecting increasing quantities of marrow cells into lethally irradiated mice. The experiment confirmed this hypothesis. But being the ever-imaginative observer, McCulloch noticed a change on the spleen surfaces of the test animals. The spleens were covered with small nodules. McCulloch began to count the nodules and drew a stunning conclusion. The frequency of these nodules correlated with the number of injected marrow cells. Subsequent investigations showed that the nodules contained thousands of blood cells. Some of the nodules were composed of a single type of blood cell while

others contained multiple cell types, representing the heterogeneity usually seen in the marrow. Subsequent experiments confirmed that each one of these nodules could be derived from a single cell. Based on the size of the nodules, this cell must be endowed with a high-growth potential. The single cell origin of nodules comprising multiple blood cell types rendered the ultimate proof for the existence of a blood-forming stem cell. These cells are not only capable of producing billions of blood cells on a daily basis, but also guarantee lifetime maintenance of the system through their ability to reproduce themselves.

We now appreciate intricate control mechanisms that have to be in place for orderly marrow function and to provide the ability to adapt cell production rates rapidly to increasing demands as they may be required during severe blood loss or infections. We also appreciate the dangers if marrow function ceases to exist, such as in aplastic anemia, or is altered to produce diseased blood cells, such as in leukemia.

Blood and marrow cells are a renewable resource. They keep us well and they give us the opportunity to share their power by facilitating modern transfusion practices and stem-cell transplantation for patients in need.

Till and McCulloch inaugurated stem cell research in Toronto and inspired numerous scientists and clinical practitioners here and elsewhere to continue their imaginative work. They have received numerous national and international awards as a testimony of their ground-breaking contribution to understanding blood formation in health and disease and to strive for innovative therapies.

Drs. Till and McCulloch honoured at the University of Toronto.

Dr. Hans Messner, renowned scientist and physician, was named to the Order of Ontario in 2015 for his pioneering work in bone marrow and stem cell transplantation. Messner cites the imaginative mentorship of Till and McCulloch as his inspiration to advance stem cell transplantation from an experimental procedure to routine therapy.

Realizing the dream: The discovery of insulin

By Michael Bliss

HAVE THEY ROBBED DIABETES OF ITS TERRORS?

Shown in these pictures are the four Toronto medical men on the University staff who figure most prominently in the discovery of a pancreatic extract to be used in the clinical treatment of diabetes in human beings. That is one of the most important medical discoveries of modern research, whose possibilities as an ultimate cure of this dread disease are very encouraging, as may be gathered from the announcement to-day of the success of the extract on sixty human patients at the Toronto General Hospital since January this year. Dr. F. G. Banting on the upper left, a young man of 30, a graduate from Toronto University in 1916, brought his hypothesis at the hour of the experiments with him from London, Ontario, last May. Associated with him in all the experimental work has been a younger man still, Dr. C. H. Best, only 24 years of age, on the upper right, a nephew of Mrs. Prof. Hutchison, of Wycliffe College, and a son of Dr. (H. Best, of Maine. Dr. Best on account of the promise of his work, was chosen by Prof. J. J. R. Macleod, Associate Dean of Medicine at the University, and one of the most eminent authorities on diabetic research, to assist Dr. Banting in his experiments. Dr. J. B. Collip, on the lower left, professor of bio-chemistry at the University of Alberta, on leave of absence this year as assistant professor of biological chemistry at Toronto, a graduate of 1912, has greatly facilitated the work in refining and concentrating the extract from an extensive diet that finally on human beings in the Toronto Laboratory at the General Hospital.

Star Weekly

The news was stunning. Suddenly, in early 1922, researchers at the University of Toronto announced that they had discovered an effective treatment for diabetes mellitus. The team had isolated an internal secretion from the pancreas, which they named insulin. Injections of insulin erased all symptoms of diabetes from starved, dying victims of the disease, causing them to regain weight and strength. Insulin brought these patients – mostly children – back to life.

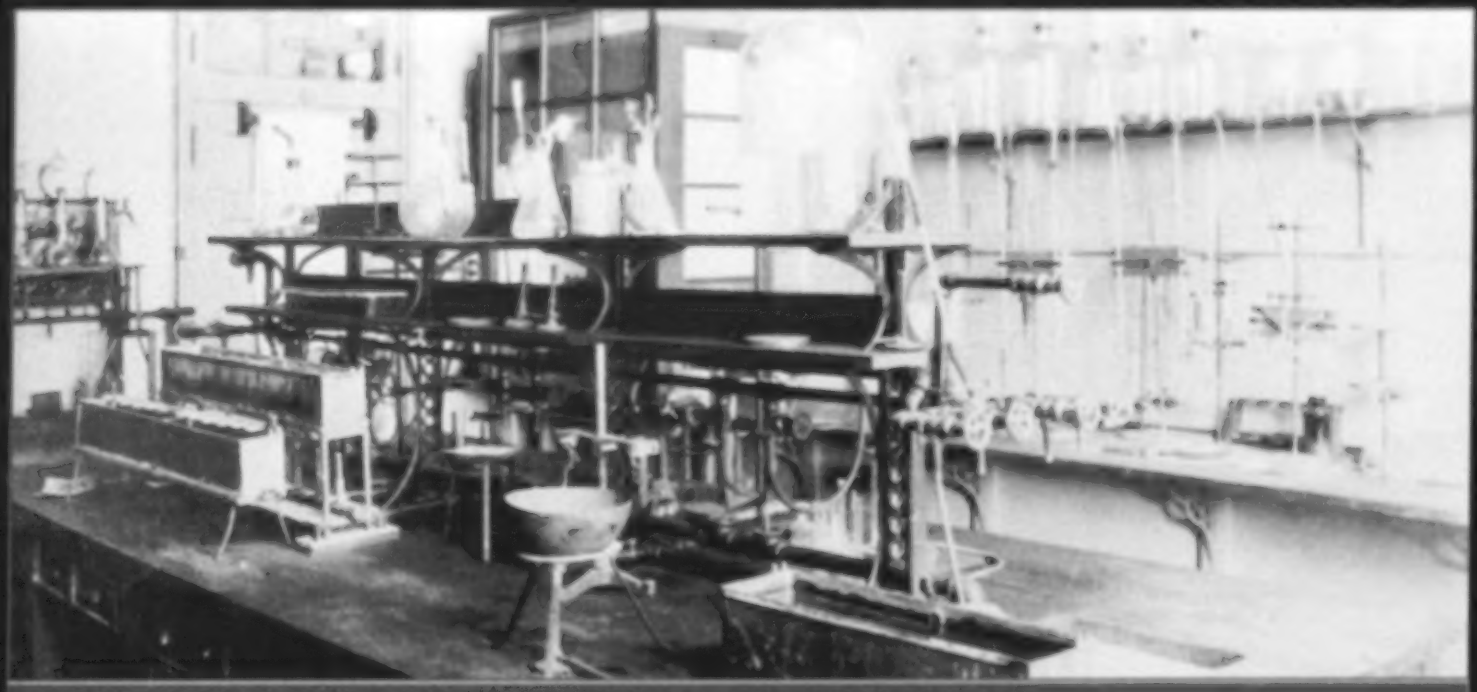
It still does. Tens of millions of sufferers from severe diabetes around the world maintain close-to-normal lives with their regular injections of insulin. Insulin was Canadian science's greatest gift to humanity.

In October 1923, the Nobel Prize was awarded to Drs. Frederick Banting and John J.J.R. Macleod for the discovery of insulin. This was the quickest honouring of a discovery in Nobel history, and remains Canada's only Nobel Prize in physiology or medicine.

Banting, who had had the idea that prompted the insulin research to begin under Professor Macleod's supervision in the physiology department at the University of Toronto, announced that he would split his share of the prize money with his student assistant, Charles Best. Macleod shared his money with a biochemist who had been added to the team, James B. Collip.

For many years, there was much puzzlement and controversy about how the credit for the discovery of insulin should be allocated. Most Canadians, and many others, came to believe that insulin had been discovered only by Banting and Best, working on their own and only getting some vague help in the later stages from Macleod and Collip. But once the full documentary record of the insulin research became available, it became evident that Banting and Best had only started a ball rolling – Macleod had indicated the directions in which it should roll, and Collip had supplied the final push to achievement. Discovering insulin had been a collaborative effort, involving at least four scientists.

Toronto Star weekly newspaper clipping of March 26, 1922 shows (from top left, clockwise) Frederick Banting, Charles H. Best, James B. Collip and J.J.R. Macleod. This photograph collage was reprinted in several Canadian newspapers. Courtesy Thomas Fisher Rare Book Library, University of Toronto. Banting Collection. C10025



Photograph of laboratory 221 in the Old Medical Building, University of Toronto. This was the laboratory in which Banting and Best carried out some of their research in 1921-22. Courtesy Thomas Fisher Rare Book Library, University of Toronto. Banting Collection. P10043

Working as a team at the University of Toronto, an institution newly equipped to support advanced research, was key to their achievement. The background story to the coming of insulin was the way in which the people of Toronto, Ontario and Canada had come to believe in the importance of research in the early years of the 20th century. They had decided that Ontario's provincial university should develop the capacity to conduct world-class experimentation and that Canada should be on the frontier of modern science, contributing to discovery and progress.

Governments, alumni and philanthropists had poured resources into building the University of Toronto's physical and intellectual research capacity. Thus, when Frederick Banting, a practising physician, took a crude idea to do some research into diabetes back to his alma mater, he was welcomed and supervised by an internationally renowned expert in carbohydrate metabolism, Macleod. He was given talented assistance by a brilliant science graduate, Best. And then he was pulled to victory by the extractive wizardry of a visiting biochemist, Collip.

Historian Michael Bliss is the author of The Discovery of Insulin and Banting: A Biography, as well as many other books. He is an Officer of the Order of Canada and, in 2016, will be inducted into the Canadian Medical Hall of Fame.

The team had all the research animals and other resources that they needed to carry out their experiments. Insulin emerged in Canada because the University of Toronto was the first research facility to assemble the expertise and resources necessary to stage an all-out assault on this problem.

"If you build it, he will come," says the voice in the classic movie Field of Dreams. In the early years of the 20th century, Ontario's and Canada's leading university had been redirected to become a field of medical dreams, where it was hoped that great things might happen. Almost unbelievably – you'd think it had been scripted – Banting came up with his idea, and a great research game was played with amazing success.

The real beneficiaries, of course were not particularly interested in the scientists' struggles for credit. They just wanted to celebrate their good fortune in having access to one of the greatest and most dramatic breakthroughs in the history of medicine. As a wise physician said at Toronto's Nobel dinner in 1923, "In insulin, there is glory enough for all."

Web resources

These web resources listed below provide an introduction to the history of medical science and innovation in Ontario:

Banting House
www.diabetes.ca/about-cda/banting-house

Canadian Bulletin of Medical History
www.cbmh.ca/index.php/cbmh

The Canadian Medical Hall of Fame
http://cdnmedhall.org

Canadian Museum of History: Making Medicare – The History of Healthcare in Canada, 1914-2007
www.historymuseum.ca/cmc/exhibitions/hist/medicare/medic-1h04e.shtml

Canadian Museum of History: Canadian Nursing History Collection
www.historymuseum.ca/cmc/exhibitions/hist/nursing/ncint01e.shtml

Canadian War Museum: Life at the Front: Medicine
www.warmuseum.ca/firstworldwar/history/life-at-the-front/medicine/medical-treatments

Community Memories. Serving Our Veterans, Serving Our Community (1946-2011) – Sunnybrook Archives, Toronto (Virtual Museum of Canada)
www.virtualmuseum.ca/sgc-cms/histoires_de_chez_nous-community_memories/pm_v2.php?id=exhibit_home&fl=0&lg=English&ex=00000780

The Discovery of Insulin at the University of Toronto: an exhibition celebrating the 75th anniversary
https://fisher.library.utoronto.ca/content/discovery-insulin-university-toronto-exhibition-celebrating-75th-anniversary

Fisher Rare Book Library: Hannah Collection, History of Medicine
www.library.utoronto.ca/fisher/collections/medicine.html

Getting Better (Virtual Museum of Canada)
www.virtualmuseum.ca/virtual-exhibits/exhibit/getting-better

The Healing Power of Plants (Virtual Museum of Canada)
www.virtualmuseum.ca/virtual-exhibits/exhibit/healing-power-of-plants

Hillary House National Historic Site and the Koffler Museum of Medicine
http://aurorahs.com/about-us/hillary-house-national-historic-site-the-koffler-museum-of-medicine

Medical Records at the Archives of Ontario
www.archives.gov.on.ca/en/explore/online/health_records/index.aspx

Museum of Healthcare at Kingston
www.museumofhealthcare.ca

National Aboriginal Health Organization (NAHO): Traditional Knowledge
www.naho.ca/documents/naho/publications/tkOverviewPublicHealth.pdf

Niagara Apothecary Museum
www.niagaraapothecary.ca

The Promotion of Healthy Living in Ontario (Archives of Ontario)
www.archives.gov.on.ca/en/explore/online/health_promotion/index.aspx

Veterans Affairs Canada: The Nursing Sisters of Canada
www.veterans.gc.ca/eng/remembrance/those-who-served/women-and-war/nursing-sisters

For a complete list of resources, visit www.heritagetrust.on.ca.

This 19th century porcelain leech jar – on display at the Niagara Apothecary in Niagara-on-the-Lake – used to hold live medicinal leeches. Leeches were a popular 19th century treatment for skin infections. Still used currently in hospitals for micro surgery to maintain venous circulation. The saliva of the leech contains a useful anticoagulant.

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